

UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Ilias Manettas et al.
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Group Art Unit: 3744
Examiner: Alexis K. Cox
Title: REFRIGERATION DEVICE AND OPERATING METHOD
FOR SAME

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Commissioner for Patents

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APPEAL BRIEF

Pursuant to 37 CFR 1.192, Appellants hereby file an appeal brief in the above-identified application. This Appeal Brief is accompanied by the requisite fee set forth in 37 CFR 1.17(f).

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(1) REAL PARTY IN INTEREST

The real party in interest is BSH Bosch und Siemens Hausgeräte GmbH.

(2) RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) STATUS OF CLAIMS

Claims 10-26 are present in this application. Claims 1-9 have been canceled. Claims 10-26 have been rejected and are on appeal.

(4) STATUS OF AMENDMENTS

No Amendments have been filed since the February 19, 2010 final Office Action.

(5) SUMMARY OF CLAIMED SUBJECT MATTER

The invention relates to a refrigeration device with a thermally insulating housing enclosing an inner chamber and an evaporator arranged in the housing. Moisture from the inner chamber, which forms an ice layer over time, which in turn thermally insulates the evaporator from the inner chamber to be cooled, condenses on the evaporator during operation of the refrigeration device. This insulation impairs the efficiency of the refrigeration device so that the ice layer must be thawed from time to time to maintain efficient operation of the refrigeration device.

FIG. 1 shows a no-frost refrigeration device. The device includes a thermally-insulating housing 1, in which an inner chamber 2 for receiving cool goods and an evaporator chamber 5 separated from the inner chamber 2 by a partition 3 is formed by openings or in the partition 3 communicating with the inner chamber 2. Arranged in the evaporator chamber 5 is a plate-like evaporator 7 supplied with coolant by a refrigerating machine 6 and, in close contact with the latter, a defrosting unit 8. See page 5, lines 5-15.

The evaporator chamber 5 and the openings 4 are designated jointly as an air duct. A monitoring circuit 10 controls operation of the refrigerating machine 6 and a ventilator 11 arranged on the upper opening 4 by means of a measuring signal by a temperature sensor in the inner chamber 2. See page 5, lines 20-32.

A first temperature sensor 12 is attached directly to a surface of the evaporator 7, which is stroked by the air current circulating through the air duct when the ventilator 11 is running and on which as a result moisture precipitates from this air current and over time forms an ice layer 13, shown as a lightly hatched surface. A second temperature sensor 14 is arranged in the upper opening 4, from which air cooled in the evaporator chamber 5 flows back to the inner chamber 2. See page 5, line 33 - page 6, line 6.

To keep the temperature in the inner chamber 2 in a nominal range, the evaporator 7 is conventionally operated at intervals, that is, supplied by the refrigerating machine 6 with liquid coolant. The monitoring circuit 10 detects the difference between the temperatures measured by the sensors 12 and 14 in each case with a preset time delay from when the evaporator is started up or at a point in time when the change in speed of the temperature detected by one of the temperature sensors 12, 14 has fallen below a limit value and therefore can be assumed that the temperature distribution in the air duct is no longer all that far removed by stationary distribution. The difference between the temperatures detected by the temperature sensors 12, 14 at such a point in time is at the lowest when the thickness of the ice layer is zero, and it increases with the thickness of the ice layer. This is illustrated in the graphs of FIG. 2, showing the temperature difference ΔT as a function of the layer thickness d . If this temperature difference ΔT exceeds a limit value ΔT_{\max} , it is assumed that the ice layer 13 has exceeded a critical thickness d_{\max} , requiring defrosting of the evaporator 7. If this is the case, the monitoring circuit 10 waits until the inner chamber 2 is sufficiently cooled down for the refrigerating machine 6 and the ventilator 11 to be switched off, and then closes a switch 9, via which the defrosting heating unit 8 is supplied with current. See page 6, lines 8-33.

FIG. 3 schematically illustrates an enlarged detail of a refrigeration device where the

two temperature sensors 12', 14' are held on a carrier 15 made of a poor heat-conducting material, which is attached, e.g. adhered to a surface of the evaporator 7, on which an ice layer 13 can form. FIG. 4 shows the temperature difference ΔT detected under the same conditions as in the embodiment of FIG. 1 between the sensors as a function of the thickness d of the ice layer. As long as the thickness of the ice layer is less than the distance d_1 of the temperature sensor 12' from the surface of the evaporator 7, both temperature sensors are subjected to the air current in the evaporator chamber 5, and their temperature is determined substantially by that of the air current. Since the distancing of the second temperature sensor 14' from the evaporator 7 is greater than that of the first sensor 12', the second sensor is in any case slightly warmer than the first. As soon as the ice layer 13 begins, however, to grow out over the first sensor 12', it impairs the temperature balance between the sensors, and the temperature of the sensor 12' is determined as stronger than previously by the temperature of the evaporator 7, recognizable on a kink in the curve of FIG. 4 by the thickness d_1 . See page 7, line 5 - page 8, line 5.

Specific Support for Independent Claims

Independent claim 10 defines a refrigeration device including a thermally insulated housing 1 that encloses an inner chamber 2 and an evaporator 7 arranged in the housing and separated from the inner chamber. [Page 5, lines 5-15.] The evaporator includes a surface where an ice layer forms during operation. A pair of temperature sensors 12, 14 are placed in the vicinity of the evaporator such that for a given thickness of the ice layer, only one of the temperature sensors is embedded in the ice layer. [Page 5, line 33 - page 6, line 6.] A heating device 8 is provided for heating the evaporator, and a monitoring circuit 10 is connected to the pair of temperature sensors. The monitoring circuit determines the difference (ΔT) between the temperature values detected by the pair of temperature sensors and activates the heating device when the temperature difference exceeds a predetermined value (ΔT_{max}). [Page 5, line 20 - page 6, line 33.]

Independent claim 16 defines a refrigeration device including a thermally insulating housing 1 enclosing an inner chamber 2 and an evaporator 7 arranged in the housing and

separated from the inner chamber. [Page 5, lines 5-15.] The evaporator includes a surface where an ice layer forms during operation. A pair of temperature sensors 12, 14 are placed in the vicinity of the evaporator such that for a given thickness of the ice layer only one of the temperature sensors is embedded in the ice layer. [Page 5, line 33 - page 6, line 6.] A carrier 15 is attached to the evaporator surface, wherein a first one of the temperature sensors is arranged directly on the carrier adjacent the surface of the evaporator and the second one of the temperature sensors is arranged on the carrier at a distance from the first one of the temperature sensors and the surface. [Page 7, lines 5-15.] A heating device 8 is provided for heating the evaporator, and a monitoring circuit 10 determines the difference between the temperature values detected by the temperature sensors and activates the heating device when the temperature difference exceeds a predetermined value. [Page 5, line 20 - page 6, line 33.]

Independent claim 17 defines an operating method for a refrigeration device including the steps of (a) positioning the pair of temperature sensors in the vicinity of the evaporator [page 5, line 33 - page 6, line 6]; (b) detecting a difference between temperature values detected by the pair of temperature sensors [page 6, lines 8-33]; and (c) deciding that a defrosting procedure is necessary if the difference exceeds a limit value [page 6, lines 8-33].

Independent claim 26 defines a refrigeration device including a thermally insulating housing 1 including an inner chamber 2 for receiving refrigerated goods and an evaporator chamber 5 separated from the inner chamber by a partition 3. The partition includes openings defining a cooling channel between the evaporator chamber and the inner chamber. [Page 5, lines 5-15.] An evaporator 7 is disposed in the evaporator chamber and includes a surface where an ice layer forms during operation. A first temperature sensor 12 is attached directly to the surface of the evaporator, and a second temperature sensor 14 is disposed in one of the openings in the partition between the evaporator chamber and the inner chamber such that the second temperature sensor is not disposed in either the evaporator chamber or the inner chamber. [Page 5, line 33 - page 6, line 6.] A heating device 8 is provided for heating the evaporator, and a monitoring circuit 10 is connected to the first and second temperature sensors and communicates with the heating device, where the monitoring circuit is

programmed to determine the difference (ΔT) between the temperature values detected by the first and second temperature sensors and to activate the heating device when the temperature difference exceeds a predetermined value (ΔT_{max}). [Page 5, line 20 - page 6, line 33.]

(6) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Whether claims 10-12, 14, 17 and 20-22 are unpatentable under 35 U.S.C. §102(b) over U.S. Patent No. 3,839,878 to Tilmanis.

B. Whether claims 13 and 15 are unpatentable under 35 U.S.C. §103(a) over Tilmanis.

C. Whether claims 18 and 19 are unpatentable under 35 U.S.C. §103(a) over Tilmanis in view of U.S. Published Patent Application No. 2001/0054292 to Davis et al.

D. Whether claims 13, 15, 16 and 23-25 are unpatentable under 35 U.S.C. §103(a) over Tilmanis in view of U.S. Patent No. 4,345,441 to Hansen.

(7) ARGUMENT

A. *Claims 10-12, 14, 17 and 20-22 are not unpatentable under 35 U.S.C. §102(b) over Tilmanis.*

With regard to independent claim 10, in contrast with Tilmanis, claim 10 recites that the pair of temperature sensors are placed in the vicinity of the evaporator. Tilmanis rather describes that one thermistor 36 is arranged in contact with the coil of the evaporator 18, while the other thermistor 38 is arranged within the frozen food storage chamber 12. See col. 4, lines 17-19. In this context, the Examiner contends that the phrase “in the vicinity” must “clearly” include the frozen food storage chamber. The Examiner reasons that since the evaporator is what is used to make the air in the frozen food chamber cold, it must necessarily be “in the vicinity” of the evaporator. Appellants respectfully disagree.

This argument is akin to saying that a tenth floor space in a commercial building is “in the vicinity” of the basement or first floor where an air conditioning unit resides since the air conditioning unit serves to cool the atmosphere on the tenth floor. To the contrary, in the context of the present invention, reference to the “vicinity” of the evaporator is defined by

reference to the thickness of an ice layer. Claim 10, for example, recites that the pair of temperature sensors are placed in the vicinity of the evaporator *such that* for a given thickness of the ice layer only one of the temperature sensors is embedded in the ice layer. By this language, it is clear that the “vicinity” encompasses a distance only slightly greater than that of an ice layer formed on the evaporator. Claim 17 defines related subject matter. In Tilmanis, on the other hand, with the thermistor 38 within the food storage chamber 12, the thermistor 38 is more susceptible to temperature variations within the chamber, which is dependent on many factors including, for example, ambient air temperature, ambient air humidity, the frequency with which the refrigerator door is opened, the nature of the goods stored in the chamber, etc. As also discussed previously, by placing the thermistor 38 within the food storage chamber 12, the thermistor 38 is more susceptible to damage, for example by the user placing goods or impacting the thermistor with goods in the chamber and/or inaccurate temperature readings for example by the user placing a frozen item in direct contact with the thermistor 38.

In the “Response to Arguments” section in the Final Office Action, the Examiner references a definition of “vicinity” from the Oxford English Dictionary. Appellants note that there are degrees of “being near in space,” and under U.S. patent law, it is appropriate to consider the terms used in the claims as defined in the specification. As noted above, in the context of the present invention, reference to the “vicinity” of the evaporator is defined by reference to the thickness of an ice layer. By this language, it is clear that the “vicinity” encompasses a distance only slightly greater than that of an ice layer formed on the evaporator.

Appellants thus respectfully submit that claims 10 and 17 are distinguishable from Tilmanis and that the rejection is misplaced.

With regard to the dependent claims, Appellants submit that these claims are allowable at least by virtue of their dependency on an allowable independent claim and also because they recite additional patentable subject matter.

B. *Claims 13 and 15 are not unpatentable under 35 U.S.C. §103(a) over Tilmanis.*

With regard to claims 13 and 15, the Examiner recognizes that Tilmanis lacks the second temperature sensor arranged on an output of the channel terminating in the inner chamber. The Examiner contends that for Tilmanis to include this subject matter, it would have been an obvious mechanical expedient. With reference to the Amendment filed May 27, 2009, Appellants submit that the proposed modification is not suggested in Tilmanis. Tilmanis specifically discloses that the second thermistor 38 is arranged within the frozen food storage chamber 12. The placement of the second thermistor is not arbitrary. Tilmanis describes as an object of the invention to periodically sense the temperature of the evaporator coil and the temperature of a storage space of the refrigerator. Tilmanis initiates the operation of the defrost apparatus when the difference between these two temperatures exceeds a predetermined value. The modification proposed in the Office Action thus directly contrasts an express objective of the Tilmanis patent. Additionally, changing a position of the thermistor 38 would require circuit modifications and programming modifications, which are neither disclosed nor suggested in Tilmanis. Appellants thus respectfully submit that the rejection is misplaced. Moreover, Appellants submit that these dependent claims are allowable at least by virtue of their dependency on an allowable independent claim.

In the Office Action, the Examiner disregards that the proposed modification is directly contrary to specific teachings in the Tilmanis patent, providing that “it is an obvious mechanical expedient.” Whether this contention is accurate or not, even an “obvious mechanical expedient” would not be suggested by the prior art if the prior art teaches away from the proposed modification. If in fact “it is well known in the art to sense injection temperature in order to determine the temperature of a space being conditioned” in the context of the rest of the claimed features of the invention, the Patent Office should identify a prior art reference that supports this contention.

Withdrawal of the rejection is requested.

C. *Claims 18 and 19 are not unpatentable under 35 U.S.C. §103(a) over Tilmanis in view of Davis et al.*

With regard to claims 18 and 19, Appellants submit that these dependent claims are allowable at least by virtue of their dependency on an allowable independent claim and also because they recite additional patentable subject matter. The Davis publication does not correct the deficiencies noted above with regard to Tilmanis in the context of claim 17. Withdrawal of the rejection is thus requested.

D. *Claims 13, 15, 16 and 23-25 are not unpatentable under 35 U.S.C. §103(a) over Tilmanis in view of U.S. Patent No. 4,345,441 to Hansen.*

With regard to the rejection of claims 13, 15, 16 and 23-25, notwithstanding paragraphs 12 and 13 of the Office Action, the Examiner contends that “Hansen explicitly teaches that placement of a second temperature sensor in the freezer compartment is known in the art, and that it is an improvement to not locate the second temperature sensor in the inner chamber, and Hansen discloses but does not require juxtaposition of the first and second temperature sensors,” referring to col. 2, lines 13-14 and col. 1, lines 31-39. Appellants submit, however, that this contention is a mischaracterization of the Hansen patent. Nowhere does Hansen even remotely reference *not* locating a second temperature sensor in the inner chamber as an advantage. In fact, Hansen does not reference a location of the second temperature sensor at all. In this context, the Examiner refers to Hansen at col. 2, lines 1-3. This sentence in Hansen, however, merely provides that it is favorable to include a second sensor – nothing in this statement supports the Examiner’s contention.

Moreover, reference to the sensors being “closely juxtaposed” does not suggest that the sensors can be freely placed anywhere within the refrigerator. The term “juxtaposed” rather refers to the sensors being next to each other “in a space-saving construction.” In the reference to col. 1 in Hansen, Hansen describes an evaluating circuit that compares the evaporator temperature and the temperature in the refrigerated space. Hansen actually describes a sensor holder 9 that includes a frost sensor 16 and a second sensor 17 that measures the evaporator temperature. In the context of claims 13 and 15, since the sensors 16, 17 in Hansen are contained within the sensor holder 9, it is readily apparent that Hansen lacks the claimed sensor being arranged on an output of a channel terminating in the inner chamber.

With regard to claim 16, neither Tilmanis nor Hansen discloses the claimed pair of temperature sensors placed in the vicinity of the evaporator such that for a given thickness of the ice layer only one of the temperature sensors is embedded in the ice layer. Claim 16 recites that a carrier is attached to the evaporator surface, where a first one of the temperature sensors is arranged directly on the carrier adjacent the surface of the evaporator and the second one of the sensors is arranged on the carrier at a distance from the first one of the temperature sensors and the surface. The sections in Hansen referenced in the Office Action describe only that the sensor detects a temperature of the evaporator and not that the sensor is held directly on the evaporator surface. Neither Tilmanis nor Hansen discloses corresponding subject matter.

Claim 24 recites that neither of the temperature sensors is disposed in the inner chamber. Although the Examiner references claim 24 in paragraph 18, the Examiner does not reference the subject matter defined in claim 24. Tilmanis clearly provides the second thermistor 38 within the food storage chamber 12 and also endeavors to detect a temperature difference between the evaporator and the food storage chamber 12. As such, it is contrary to the teachings in Tilmanis to modify its structure as proposed in the Office Action. In addition, Hansen in fact is silent with regard to a positioning of the sensors except that the sensor holder 9 is secured to the vertical front face 25 of the evaporator 5. Both sensors are disposed in respective bores, and channels 35, 36 receive conductors that lead to the temperature sensors.

Appellants thus submit that the characterizations of the Hansen structure are inaccurate and that the rejection is thus misplaced.

Appellants further submit that the remaining dependent claims are allowable at least by virtue of their dependency on an allowable independent claim.

Claim 26 defines related subject matter, and Appellants submit that claim 26 is allowable for reasons similar to those discussed above.

(8) CONCLUSION

In view of the foregoing discussion, Appellants respectfully request reversal of the Examiner's rejections.

Respectfully submitted,

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CLAIMS APPENDIX

1-9. (Canceled)

10. (Rejected) A refrigeration device, comprising:

a thermally insulating housing;

said thermally insulating housing enclosing an inner chamber and an evaporator arranged in said housing separated from said inner chamber;

said evaporator including a surface where an ice layer forms during operation;

a pair of temperature sensors placed in the vicinity of said evaporator such that for a given thickness of said ice layer only one of said temperature sensors is embedded in said ice layer;

a heating device for heating said evaporator;

a monitoring circuit connected to said pair of temperature sensors; and

said monitoring circuit determines the difference (ΔT) between the temperature values detected by said pair of temperature sensors and activates said heating device when said temperature difference exceeds a predetermined value (ΔT_{max}).

11. (Rejected) The refrigeration device according to claim 10, wherein a first one of said temperature sensors is arranged directly on said surface of said evaporator and a second one of said temperature sensors is arranged at a distance from said surface.

12. (Rejected) The refrigeration device according to claim 11, including a channel communicating with said inner chamber, wherein said evaporator is arranged in said channel.

13. (Rejected) The refrigeration device according to claim 12, wherein said second one of said temperature sensors is arranged on an output of said channel terminating in said inner chamber.

14. (Rejected) The refrigeration device according to claim 11, wherein said evaporator is arranged in said housing separated from said inner chamber by an insulating partition having at least one channel communicating with said inner chamber through said partition, and wherein said evaporator communicates with said inner chamber through said channel.

15. (Rejected) The refrigeration device according to claim 14, wherein said second one of said temperature sensors is arranged on an output of said channel terminating in said inner chamber.

16. (Rejected) A refrigeration device comprising:
a thermally insulating housing;
said thermally insulating housing enclosing an inner chamber and an evaporator arranged in said housing separated from said inner chamber;
said evaporator including a surface where an ice layer forms during operation;
a pair of temperature sensors placed in the vicinity of said evaporator such that for a given thickness of said ice layer only one of said temperature sensors is embedded in said ice layer;
a carrier attached to said evaporator surface, wherein a first one of said temperature sensors is arranged directly on said carrier adjacent said surface of said evaporator and said second one of said temperature sensors is arranged on said carrier at a distance from said first one of said temperature sensors and said surface;
a heating device for heating said evaporator;
a monitoring circuit connected to said pair of temperature sensors; and

said monitoring circuit determines the difference (ΔT) between the temperature values detected by said pair of temperature sensors and activates said heating device when said temperature difference exceeds a predetermined value (ΔT_{max}).

17. (Rejected) An operating method for a refrigeration device, including a thermally insulating housing;

said thermally insulating housing enclosing an inner chamber and an evaporator arranged in said housing separated from said inner chamber;

said evaporator including a surface where an ice layer forms during operation;

a pair of temperature sensors positioned such that for a given thickness of said ice layer only one of said temperature sensors is embedded in said ice layer;

a heating device for heating said evaporator;

a monitoring circuit connected to said pair of temperature sensors;

said monitoring circuit determining the difference (ΔT) between the temperature values detected by said pair of temperature sensors;

the method including the steps of:

a) positioning the pair of temperature sensors in the vicinity of said evaporator;

b) detecting a difference (ΔT) between temperature values detected by said pair of temperature sensors; and

c) deciding that a defrosting procedure is necessary, if the difference (ΔT) exceeds a limit value (ΔT_{max}).

18. (Rejected) The method according to claim 17, wherein said steps b) and c) are in each case performed after a preset delay after said evaporator is started up.

19. (Rejected) The method according to claim 18, wherein said steps b) and c) are performed if the speed of change of the temperature on at least one of both sensors has fallen below a predetermined limit value.

20. (Rejected) The method according to claim 17, wherein said evaporator is heated when it has been decided that a defrosting procedure is necessary.

21. (Rejected) The method according to claim 17, including said monitoring circuit detecting said temperature difference and deciding that said defrosting procedure is necessary.

22. (Rejected) The method according to claim 21, including said monitoring circuit activating said heating device when said temperature difference exceeds a predetermined value (ΔT_{\max}).

23. (Rejected) The refrigeration device according to claim 11, wherein said second one of said temperature sensors is disposed adjacent a ventilator positioned between said evaporator and said inner chamber.

24. (Rejected) The refrigeration device according to claim 10, wherein neither of said temperature sensors is disposed in said inner chamber.

25. (Rejected) The method according to claim 17, wherein step a) is practiced by positioning a first one of said temperature sensors directly on said surface of said evaporator and positioning a second one of said temperature sensors adjacent a ventilator positioned between said evaporator and said inner chamber.

26. (Rejected) A refrigeration device comprising:
a thermally insulating housing including an inner chamber for receiving refrigerated goods and an evaporator chamber separated from the inner chamber by a partition, the partition including openings defining a cooling channel between the evaporator chamber and the inner chamber;

an evaporator disposed in the evaporator chamber, said evaporator including a surface where an ice layer forms during operation;

a first temperature sensor attached directly to said surface of the evaporator;

a second temperature sensor disposed in one of the openings in the partition between the evaporator chamber and the inner chamber such that the second temperature sensor is not disposed in either the evaporator chamber or the inner chamber;

a heating device for heating said evaporator; and

a monitoring circuit connected to said first and second temperature sensors and communicating with said heating device, wherein said monitoring circuit is programmed to determine the difference (ΔT) between the temperature values detected by the first and second temperature sensors and to activate said heating device when the temperature difference exceeds a predetermined value (ΔT_{max}).

EVIDENCE APPENDIX

None

RELATED APPEALS APPENDIX

None